Statistical Analysis of Infant Mortality and its Causes In the United Kingdom

BY

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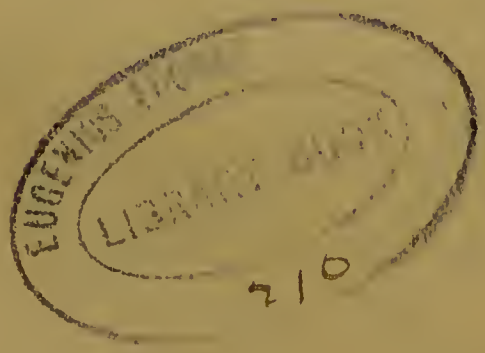

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PREFACE.

THROUGHOUT this paper the subject of Infant Mortality has been treated from the statistical point of view, *i.e.*, from the standpoint of the collection of facts rather than the setting forth of theories, either biological or sociological. Readers who study the tables here given will doubtless draw their own conclusions, which may possibly differ from those suggested in the latter part of the paper.

Obviously, the subject of Infant Mortality is too big a one to be adequately treated in so few pages, and this pamphlet does not pretend to be more than an introduction to its study. There is great need for further investigation as to the causes for this high death-rate among infants, and much good will be done if medical officers of health in all parts of the country, and others whose work gives them the opportunity, will continue to collect facts and make observations on the subject from the scientific point of view, as suggested at the conferences held at Caxton Hall in 1906 and 1908.

If the diseases of infancy were scientifically and uniformly classified all over the United Kingdom, the work of future students would be greatly simplified and improved.

I have to thank Dr. George Reid, D.P.H., Medical Officer of Health for Staffs County Council, for most kindly reading through the proof-sheets at very short notice.

H. M. B.

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LIST OF AUTHORITIES CONSULTED.

70th Annual Report of Registrar-General of Births, Deaths, and Marriages in England and Wales, for 1907 (issued 1908).

52nd Detailed Annual Report of Registrar-General of Births, Deaths, and Marriages in Scotland (abstracts for 1906) (issued 1908).

53rd Annual Report of the Registrar-General on the Births, Deaths, and Marriages registered in Scotland during the year 1907 (issued 1908).

44th Detailed Annual Report of the Registrar-General for Ireland, containing a general abstract of the numbers of marriages, births, and deaths registered in Ireland during the year 1907 (issued 1908).

Report of the Public Health Committee of the London County Council, submitting the report of the medical officer of health of the county for the year 1907 (issued 1908).

Annual summaries of births, deaths, and causes of death in England and Wales and in London and other large towns, years 1903 to 1908.

The reports of the medical officers of health for principal towns in England and Wales, Scotland and Ireland, and for the county of Staffordshire for 1907 and for 1908, where these could be obtained.

Annual Reports of the Chief Inspector of Factories and Workshops, 1906 and 1907.

Report of the Inter-departmental Committee on Physical Deterioration, 1904.

Report of the Royal Commission on the Poor Laws and Relief of Distress, 1909.

Report of the Proceedings of the National Conferences on Infantile Mortality held at Caxton Hall, 1906 and 1908.

Infant Mortality (Dr. Newman, 1906).

Report on Inquiry into Employment of Women after Childbirth, prepared by the Christian Social Union, London, Research Committee, July, 1908.

Dangerous Trades (Dr. Oliver).

National League for Physical Education and Improvement, Leaflet No. 4, Health Visiting.

N.B.—The actual figures in the tables are taken from the different reports of the Registrar-General, or local medical officers of health, but the arrangement of the tables is original, and in no case are they copied as they stand from any tables given by other authorities.

INFANT MORTALITY.

INTRODUCTION: THE FACTS.

(*See* TABLES I. TO VI. AND X. AND XI.)

THE high rate of mortality among children before they reach the age of one year is one of the most complex and difficult of modern social problems. And, like many problems, the more deeply it is studied, the more difficult it seems of solution. The facts and statistics refuse to arrange themselves in an orderly manner, and the student is forced to the conclusion that there is not one cause for the death of these infants, or even two or three, but a large number, and that these causes are interdependent on each other.

The facts themselves, however, are fairly simple. Though the death-rate in England and Wales has steadily gone down from 21·6 per 1,000 living persons in 1861 to 14·7 in 1908, and even in the seventy-six largest towns was only 15·8 in 1908, yet the death-rate of infants under one year per 1,000 births, which was 153 in 1861 (or an average of 154 from 1861 to 1870), was still 132 in 1906, 118 in 1907, and 121 in 1908 for England and Wales (or an average of 133 from 1901 to 1908), and in the seventy-six largest towns was 128 per 1,000 births in 1908.

Figures and comparisons will be found in the tables subjoined. In Table I. is shown the progress throughout the country of the general death-rate and the infant mortality rate. It will be seen that both have diminished, but that, while the general death-rate has diminished steadily and very considerably, the lessening of the infant mortality rate has

been slight and uncertain. In fact, it was actually at its highest points in 1895 and 1899, when it was 161 and 163 respectively, and it is only since 1904 that it seems to have shown any steady improvement, and this may be due to temporary causes only, such as the cooler weather in the third quarter of the year, to which further reference will be made.

If Tables II., III., and IV. are examined, further startling facts are revealed. In the nine counties of England and Wales with lowest rates of infant mortality, the deaths under one year average only 80 per 1,000 births for 1907, and in Scotland in the nine lowest counties only 67 per 1,000 births in 1906, while among the rural population of Ireland the rate was only 70 per 1,000 births in 1907, the average death-rate of these same English counties being 11·4, Scotch 12·6. Yet in ten other counties of England and Wales the deaths under one year per 1,000 born averaged 132, in the ten highest in Scotland 117, and in the civic unions of Ireland 124, the ordinary death-rate being 16·7 for these English and 16·4 for the Scotch counties. Why these extraordinary disparities?

One or two general observations, both negative and positive, can be roughly made from these tables. First, that difference in the geographical position or climate does not account for the disparity. Orkney and Shetland, at the north of the United Kingdom, have the lowest rates of all, yet Aberdeen, nearly as far north, has a much higher rate than counties in the south of England, such as Dorset and Wilts. At first sight the whole thing seems haphazard. It is, however, obviously a fact that the districts which contain a large population relative to their area, *i.e.*, which are urban, have always a higher infant mortality than those which have a scattered and rural population. (*See also* Table X.) This is a deduction which can be made in a general way from all infant mortality statistics. But it will be found to be a general broad statement only, and it will not bear further tabulation.

No towns set in order of population will have an infan mortality rate in equal proportion. (*See* Table V.) London,

with a population of nearly five millions in 1907, had only an infant mortality rate of 116, less than that for the whole of England and Wales, which was 118. Again, in Portsmouth, with a population of over 208,000, only 99 out of every 1,000 babies born died in 1908, and yet in Rhondda, with nearly 80,000 less population, out of each 1,000 infants born 184 failed to reach the age of one year.

If the density of population or proportion of over-crowded is estimated, some more helpful results can be obtained, yet even here statistics fail to give satisfactory results; for instance, Bolton and Bradford have the low number of 11·9 and 12·7 persons per acre, but an infant mortality of 148 and 143 for 1908, larger than that of South Shields, with a density of 47·3, infant mortality 133, and Bristol, density 20·8, infant mortality 126. (*See* Table V.)

The Registrar-General has taken the percentage of persons living more than two in a room to seek to prove in another way whether overcrowding and infant mortality go together. Undoubtedly, this is true as a general statement, but yet his table shows many anomalies. (*See* Report Registrar-General for England and Wales, 1907, p. xlv.) Aberdare, with only 5·8 overcrowded, has one of the highest rates of infant mortality, so have Burnley and Farnworth (Lancashire, textile) and Tunstall, Longton, and the other pottery towns, though scarcely overcrowded at all, according to this way of reckoning, and towns which show a percentage of 12 to 20 have a lower rate of infant mortality. (*See* Table VI.)

Another factor, which has been constantly included in tables of statistics, is the proportion of women who are employed in industry. These statistics, of all those used in these investigations, are the most misleading. To be of any value, it is necessary to know the proportion of *married* women of child-bearing age so occupied; secondly, it must be remembered that it is impossible for any statistics available to estimate correctly the number of women employed in casual work, such as charing, etc., or in home work, and

it is quite as likely that these occupations, as well as factory work, may lead to evil results to children, both born and unborn. Too hard work even in ordinary household duties may lead to premature birth, and to the artificial feeding of the baby through lack of breast milk, or weakness in the mother.

These figures must, therefore, be taken with reservation. Wood Green, with 31·1 per cent. married or widowed women occupied, has an average infant mortality rate of only 98 from 1903 to 1907; Aberdare (Glamorganshire), with only 4·7 such women occupied, has a rate of 191. On the other hand, statistics abundantly prove that the *kind of occupation* in the district does affect the infant mortality rate, though the exact connection between cause and effect is difficult to prove. The occupations of the 31 per cent. women in Wood Green, for instance, are entirely different from the 17·5 of Tunstall (Staffs.), with its average infant mortality rate of 203 for 1903–7, or Farnworth (Lancashire), with 21·6 per cent. married or widowed women occupied, and an average infant mortality of 211. The Registrar-General remarks in his report that "it has been frequently pointed out that those divisions of the country that comprise the districts of the mining, textile and pottery industries show very badly in the tables of infant mortality." (*See* Table VI. (a).)

It is impossible to give any exact figures connecting poverty with infant mortality, but one thing seems quite clear, that towns, such as Portsmouth, Croydon, Bristol, which have a mixed population, *i.e.*, a variety of classes and occupations, and a mixture of well-to-do and very poor, always have a very much better rate of infant mortality than such places as the great textile towns of Lancashire and Yorkshire, the potteries of Staffordshire, or the mining districts of Northumberland, Durham, and South Wales, where the well-to-do live outside the district, and the working classes all follow the same occupation, *although* in most cases the average wage of the same class in the latter group of towns would be higher than that of the first mentioned. It does not seem to be the actual kind of work, or even the

fact of the women being employed (few married women go out to work in Glamorganshire or Durham, yet the county rates are 136 and 135, third and fourth on the list), or even the poverty; the infant mortality rate seems to depend on something behind all that, on the subtle and almost indefinable conditions of life.

It does not depend either in more than a general way on the actual sanitary conditions, as, if it did, it would follow more closely the general death-rate. It will be noticed, too, that a high birth-rate usually, though not invariably, accompanies a high rate of infant mortality. (*See* Table V.) Rhondda, for instance, the highest for infant mortality, has a birth-rate of 40·3, by far the highest of all the birth-rates in the table. Nottingham, Leeds, and Bradford, on the other hand, have moderate or low birth-rates and high rates of infant mortality. (*See also* Table XI.)

Before going further into the general conditions, however, it seems advisable to investigate and tabulate the actual causes of death among these unfortunate infants.

I.

DIRECT CAUSES.

(*See* TABLES VII. AND VIII.)

OF the direct causes which led to the death of infants under one year in England and Wales in 1907, it will be seen in Table VII. that bronchitis, laryngitis, and pneumonia claimed 23·43 of the 117·62 victims per 1,000 births (pneumonia 12·51, bronchitis 10·75). The next in order was premature birth, with 19·85, of which 17·89 died under one month old. Wasting diseases taken together, in fact, caused the largest number of deaths, viz., 43·18, atrophy, debility, and marasmus accounting for 15·01. Diarrhœal diseases come next, with 14·06, and then convulsions, a vague and non-scientific definition, as so-called convulsions may mean several kinds of fits, and may proceed from various causes, one of the most common being incorrect feeding, which leads to either a relaxed or constipated state of the bowels, followed in thousands of cases by death from diarrhœa or "convulsions." Common infectious diseases caused the death of 8·67, congenital defects 6·60, of whom 4·91 died under one month and 1·16 under one day old, tuberculous diseases 4·54. Other causes were erysipelas 0·23, syphilis 1·23, rickets 0·50, meningitis (not tuberculous) 1·77, undefined 7·07. The deaths from infectious diseases are diminishing year by year, while those from prematurity, congenital defects, diarrhœa, and pneumonia are increasing in proportion. (*See* "Report on Physical Deterioration.")

If, instead of taking the whole of England and Wales, the rural counties only are taken, the greatest difference is found under diarrhœal diseases, which drop from 14·06 in all England to 9·16 in rural counties; the only causes which show a slight increase (under 1 per cent.) are atrophy,

debility, marasmus, and convulsions, owing possibly partly to a looser classification in country districts. Diarrhœal diseases in urban counties, on the other hand, accounted for 16·63 of the 127·66 deaths per 1,000 births, as against 14·06 in all England and 9·16 in rural counties, and pneumonia and bronchitis for 26·26, as against 23·43 in all England and only 17·35 in rural counties. These facts seem to point to three indirect causes in urban districts: (1) incorrect feeding and (2) bad sanitary conditions as indicated by the prevalence of diarrhœa, and (3) exposure of the babies to cold (leading to pneumonia, bronchitis, etc.), owing to mothers in urban districts going out to work and taking their babies to neighbour or crêche in the raw early morning and fetching them again in the cold of the evening, or taking them with them on shopping, public-house, or pleasure expeditions, especially on Saturday and Sunday nights.

Unfortunately, the classification of the diseases is so different in the reports of the various officers of health that it has not been found possible to include the *causes* of death in Table V., as was at first intended, but three typical towns, one with the pottery industry (Longton, Staffs.), one with textile (Blackburn, Lancashire), and one with mixed industries (Croydon), have been taken in Table VIII. It has been thought best to give *actual* numbers as well as percentage per 100 deaths, as the totals are not very high. And of course figures for *one year* only must not be taken to prove too much. Still, on comparing Tables VII. and VIII., one obvious fact is seen at once, viz., that the number of deaths from diarrhœa is very much larger in the industrial towns: 30·8 in Longton and 22·5 in Blackburn per 100 deaths, and only 15·5 per 100 deaths in Croydon. The deaths from prematurity, congenital defects, atrophy, etc., are, on the contrary, in larger proportion in Croydon (42·9 per cent.) than in Blackburn (33·3 per cent.) or Longton (27·6 per cent.). Bronchitis and pneumonia, as might be expected, have a larger percentage of victims in the industrial towns.

It would be a very great step forward if all medical officers of health could be induced to tabulate their statistics as to

causes of death in the same way. Until this is done no thoroughly satisfactory tables can be made on the subject of infant mortality.

(*a*) Diarrhœa. (*See* Tables VII., VIII., and IX.)

Diarrhœa is always much more prevalent in the third or autumnal quarter of the year, and much worse in hot and dry summers. This is not surprising when we remember that dust and flies are the carriers of this disease, and that putrefying food and contaminated milk are the means by which it is commonly introduced. It has been computed that a fly can carry 100,000 bacteria on its feet and body.[1]

The Medical Officer of Health for Liverpool (Report, 1907) states "that the deaths amongst children under three months of age either wholly or partially fed on artificial foods are fifteen times as great as they are amongst an equal number of infants fed upon breast milk; *e.g.*, investigation has tended to prove that, out of every 1,000 infants under three months of age naturally fed on breast milk alone, 20 die of autumnal choleraic disease, but if the same number of infants at the same age are artificially fed, then, instead of 20 dying, as many as 300 will die from this cause."

As to the connection between meteorological conditions and the prevalence of zymotic diarrhœa during the third quarter of the year, this is abundantly proved by statistics and diagrams in many of the reports of the medical officers, including the one for Liverpool. (*See* Table IX.)

The Medical Officer for Kingston-upon-Hull also gives valuable statistics on this subject. (*See* Table IX.) From these it will be seen that, where there is a high temperature combined with a low rainfall, the deaths from diarrhœa are always high.

Again, there is a real connection between diarrhœa and defective sanitary conditions. Privy middens, cesspools, dirty houses and those out of repair, are decidedly likely to increase the disease.

[1] Report of Medical Officer, Smallthorne.

To quote from the Report of the Medical Officer for Cork, 1907, "diarrhœa may be classed among the filth diseases, the fundamental condition favouring it being an unclean soil, the particular poison from which becomes air-borne and so swallowed with the food, more especially milk, which is usually found to be kept either in open vessels or dirty bottles, exposed in the most stuffy places to the contamination of flies which are swarming about the kitchens or living rooms of those houses where the prompt removal of house refuse should be insisted on. . . . Out of 413 cases it was found that overcrowding existed in 230 cases. The houses and surroundings were filthy in nearly every case."

In Cork this disease is made compulsorily notifiable from July 1st to October 31st in each year, a plan which should prove beneficial in lessening the attack rate if, at the same time, instructions be circulated setting forth the causes of and remedies for the disease, warning against giving children unripe or over-ripe fruit or unsound food of any kind, and recommending the boiling of milk and keeping the milk covered and the procuring of medical attendance for the child as soon as it is attacked by the first symptoms of the disease. Mothers should also be regularly informed as to the danger of giving young infants unsuitable food of any sort, and taught to use cows' milk properly prepared if they cannot feed their babies themselves. But even babies fed from a milk depôt, where all precautions are taken, do occasionally contract diarrhœa, though the percentage is very low compared to that among infants otherwise fed. The lowest percentage of course by a very long way is among the infants who are breast-fed. (*See* Table IX.) "Hand-fed infants are specially liable to fatal attacks" (of diarrhœa) "for two reasons: first, because they run more risk of infective material being introduced with their food; and secondly, because hand-feeding, unless conducted with the greatest circumspection, and with the most careful adaptation to the digestive capacity of the individual child, is apt to induce intestinal catarrh or other digestive disturbances which render the bottle-fed babies unduly susceptible to diarrhœal

disease" (Report of Medical Officer for Croydon, 1908. *See also* Table IX.).

From statistics given in the Croydon report, it is seen "that diarrhœa is about seven times more prevalent among infants under six months of age fed on cows' milk than on those fed on the breast alone, while the incidence on infants fed on condensed milk is twice as high as on those fed on ordinary cows' milk and *fourteen* times as high as on the breast-fed. It cannot therefore be too strongly urged," the medical officer concludes, "that breast-feeding is by far the most important means of checking diarrhœa, though under urban conditions it will not entirely prevent the disease, unless all the other requirements of domestic hygiene are attended to."

It has already been noted that diarrhœa is very much more fatal in urban than in rural districts, and in pottery or textile towns than in towns with ordinary mixed industries. (*See* Tables VII. and VIII.) This is largely owing to the fact that the mothers go out to work, and do not feed their babies themselves, and also to the bad sanitary conditions which prevail in some of these towns. Of the 102 babies who died of diarrhœa in Longton in 1908, only 57 were reported as having mothers at home, 52 mothers went to work, 10 were absent for other causes, 49 of the infants were fed with long-tubed bottles, and only 18 were breast-fed ; 47 of the houses had open ash-pits or none at all, 51 cesspools, 24 hand-flushed pans dirty and out of order, only 7 had water-closets, and 20 hand-flushed pans good. These figures thoroughly bear out all the facts previously stated.

The fact is, the present generation of medical officers is fighting against the evils created by the lax administration of local authorities in the past, and against the terrible ignorance and obstinacy which prevails among many in the working classes. There is no panacea against infant mortality, only the old common-sense rules as to the need for fresh air, cleanliness, sunlight, and proper food.

(*b*) Bronchitis, Pneumonia, etc. (*See* Tables VII. and VIII.)

It is not surprising to find so many children dying from bronchitis, pneumonia, etc., in urban areas, when it is remembered, as stated before, that mothers who go out to work are obliged to take the babies out early in the morning to be nursed.

"Infants who are nursed away from home during the day in Blackburn," says the medical officer, "are taken about half-past five every morning, wrapped in a shawl or blanket, where they are placed under the care of a woman, frequently beyond middle age and unable to look after any child. Similarly they are carried home again about six o'clock in the evening. . . . Unclean cradles and damp clothing have been found in some cases. The infants, however, are exposed to great changes of temperature, which certainly is a prolific cause of bronchitis. This need not occasion surprise, when it is remembered that an infant is taken from a warm bed and carried a varying distance through the cold street in the early morning, and that this act is repeated at night."

In 1907, 124 out of a total of 508 infants dying under one year perished from lung diseases (other than tuberculosis) in Blackburn. The same high percentage occurs in the Potteries. (*See* Table VIII.)

Danger of suffocation or overlaying occurs when the infant sleeps in the same bed as the parents. By the Act which came into force in 1909 this has been made a criminal offence when death ensues. It has been said that these deaths occur most commonly on Saturday and Sunday nights, when the infants have been weakened by exposure to cold, the parents having taken them out late to public-houses or shops. By the same Act children under fourteen are not allowed to be taken into public-house bars, but it is a question whether there will not be more deaths from bronchitis, etc., owing to the babies being left outside in the

street in a mail-cart, or in the arms of elder child or neighbour, as is constantly to be seen in London at any rate.

Remarks on the deaths from prematurity, etc., will be found under "Indirect Causes," (*c*) Pre-natal Causes and (*d*) the Industrial Employment of Mothers.

(*c*) Tuberculous Diseases.

Until tuberculous diseases and all forms of phthisis are made notifiable compulsorily throughout Great Britain, and until some stronger measures are taken to root out the disease in cattle, we shall have this high rate (4·54 per cent.) of deaths from tuberculous diseases under one year.

Infants are, of course, liable to contract the disease through infected milk, or from their parents if they are tuberculous.

II.

INDIRECT CAUSES.

It is of little use to classify the deaths of infants under the names of different diseases unless the conditions which lead to these diseases can be ascertained, and herein lies the most difficult problem. Almost the only way to prove whether certain evils lead to certain infantile diseases is to remove the evils, and then watch whether the death-rate from those diseases decreases. Undoubtedly it has been proved in this way that infantile diarrhœa, which is always especially prevalent in the third quarter of the year, when the weather is hot and rainless, can be greatly prevented by better sanitation and by correct feeding.

Statistics have proved over and over again that artificially reared children are far more liable to suffer from diarrhœa than those breast-fed. (*See* Table IX.) Dust is usually full of germs, and liable to get into the infant's milk unless the milk is carefully protected. The mother's milk reaches the infant without possibility of outside contamination. In towns where the privy midden system is still allowed, and where the back yards are unpaved, the houses back to back, the dustbins uncovered or only emptied at long intervals, and the street scavenging and sanitary arrangements generally defective, infant diarrhœa has always been found to be prevalent. (*See* remarks under "Diarrhœa.")

Liverpool has expended large sums of money in ameliorating the condition of the congested districts and poorer parts of the city. Milk depôts have been established, health visitors appointed, and food provided for those mothers whose inability to suckle their infants arises from poverty and malnutrition.

The medical officer of health says: "These measures

are not without their reward, and the diminution in the infant mortality in districts as a whole is encouraging. Still we want to come to closer grip with the question. When we find, for example, that in 874 families, taken consecutively on account of the fact that in each the death of an infant had occurred, the total number of infants born in those families had been 3,801, and that no less than 1,895 of them had perished, practically all in infancy—representing an infant mortality of 498 per 1,000—it is obvious that we must go further into the question of the personal element. The extended inquiry shows, side by side with this, parents under similar conditions, with the same income, following the same occupations, with the same hard struggle against poverty, and yet all or nearly all of their children reared. The question arises, To what is this remarkable difference due ? "

Cases are then given showing that in some of the very poorest homes intelligent and sober mothers have reared large families successfully on quite low wages, and that in homes where the husband gets as much as 40*s*. per week, and the parents are intemperate or idle, in many cases only one in from three to seven of those born has survived. In the Jewish community, where sobriety, and cleanliness, and thrift, and proper attention to the preparation of food is almost universal, the infant mortality is very low.

This quotation has been given to show how difficult it is found by experts to say wherein lie the causes of the mortality, but probably a large number of the indirect causes will be found to come under the head of

(*a*) The Ignorance of the Mother.

Human mothers, unluckily, have not the instinct of a bird or a cat, which know without teaching how to rear their young. In the congested industrial districts especially they commonly show an extraordinary lack of knowledge as to the feeding and clothing of their babies; they expose them to cold, give them "the same food that they have themselves," are inexperienced in the treatment of disease, use

soothing powders and other harmful drugs, and persist in allowing the child to suck that instrument known as a "comforter," which constantly falls on the floor, and is thus a fine collector of germs. The long-tubed form of feeding-bottle is also still used, though not so much as formerly. It cannot possibly be properly kept clean.

Personally, I think that one of the reasons why infant mortality is so much higher in the crowded industrial districts is that all the people are of one class, and that the most ignorant. Public opinion allows a low standard of expectation; few babies comparatively have been reared in the past, and few are expected to live in the future. Ignorant old women who have buried ten out of fourteen or fifteen children are usually the most ready to give advice, and to bring the tin of condensed milk, the long-tubed bottle, the "comforter," the soothing powders, and handy drugs. In the country districts or small old-fashioned towns it is quite different. Women of a superior calibre take a real interest in their neighbours. There is the farmer's, or the draper's, or the chemist's wife near at hand, who has been the successful rearer of healthy children, and she soon steps in with her common-sense ideas, advises the mother to feed her infant herself, preaches cleanliness, and generally shows the young and inexperienced mother how to "get along." The selfishness of the better-off has led them to remove themselves in the larger towns from their humbler neighbours, and the industrial revolution of 1750—1800 led to the herding together of thousands of workers for the factories in the midlands and in the north, and in South Wales for the mining industries. The least that can be done now is to send them health missionaries in the form of trained visitors, or lady sanitary inspectors, district nurses, and properly qualified midwives. But more of this must be said under the heading of "Remedies."

Of what use is it to teach girls to read and write and calculate if they cannot perform the ordinary duties of housewife and mother? It is to be feared that the Compulsory Education Act of 1870 has so far tended to *increase*

rather than diminish infant mortality by depriving young girls of much time which might be spent at home in learning their domestic duties, and by giving them a distaste for domesticity. Luckily the Education Department is attempting to introduce some more useful subjects into its curriculum, and is beginning to teach hygiene and the care of infants, as well as cooking, laundry work, etc., to the elder girls.

(*b*) The Surroundings of the Infant.

The material environment of the infant has also to be taken into account. Overcrowding, *i.e.*, lack of cubic space, in itself possibly does not actually cause many deaths; but the unnatural, unhappy life which is led by those who lack the conveniences, decencies, and refreshment of life undoubtedly leads to suffering. There is "no room for the baby," and it slips out of life almost unregretted.

Poverty, again, is an *indirect* cause; not many children are actually starved to death; but again, in homes where the means are quite inadequate, there is not that anxious care to keep the little one alive that is seen in the homes of the well-to-do, and weakly infants undoubtedly succumb for lack of extra nourishment, often needed by both mother and child. Bad sanitation has already been alluded to as an indirect cause, and the thriftlessness, carelessness, and drinking habits of the parents of course lead to neglect of the offspring.

(*c*) Pre-natal Causes.

Under this heading comes consideration as to the physical condition of the mother. If she is badly nourished, unhealthy, or deformed, her baby starts with little chance in life; if she suffers injury or shock during pregnancy, her infant may be prematurely born, or otherwise harmfully affected. Again, artificial means taken to prevent conception or procure abortion, if unsuccessful, undoubtedly injure the infant.

With regard to artificial interference with birth, the

Medical Officer of Health for Manchester, 1907, says: "There can, unfortunately, be little doubt that the continued descent of the birth-rate is due not merely to the prevention of conception, but also in no small measure to destruction of its fruits. If so, the effect both on natural selection and on the national habits must be injurious. The offspring must also be injured in many cases by the efforts made to bring on premature labour." The Medical Officer of Health for Bradford, 1907, also says: "Although the number of deaths (117) from premature birth is slightly less than last year, there can be no doubt that it is excessive, and many inquiries have given me good reason to conclude that prematurity is in many cases artificially brought about."

Women often take certain forms of lead as "abortifacients," and attention is called by Dr. Newman to its increasing use, especially in the midlands. In London the deaths from prematurity increased from 13·2 to 19·7 per 1,000 births from 1881 to 1900.

The effect of lead poisoning has been referred to elsewhere. It constantly leads to abortion or premature birth. The investigation of particulars of eleven families in France, where one or both parents were suffering from lead poisoning as a result of occupation in pottery works, showed that, where the mother was affected, 92 per cent. and 94 per cent. of all the children born were either dead or found to be suffering from cranial disease (Dr. Newman, p. 71).

The Medical Officer for Tunstall (Pottery district, Staffs.) reports that nearly one half of the deaths under one year in 1907 have been attributed to prematurity, atrophy, debility, marasmus, etc., regarding which he says: "They indicate serious social defects, such as intemperance, marriage of the unfit, and baneful factory employment of married women." Other poisons which may exert a bad effect on the unborn child are mercury and phosphorus.

Dr. Newman gives some interesting figures with regard to alcoholism in mothers and its effect on the children, but this is a subject in which there is room for so much difference of opinion, and there is generally much guess-work, so that

reliable statistics are impossible to get. Whatever the antenatal effect may be, however, it is obvious that a drunken mother cannot possibly rear a child so satisfactorily as a sober mother. To quote Dr. Newman, "the whole environment with which the infant is so intimately connected becomes disarranged, unclean, irregular, and this at once exerts an injurious influence. The child of an alcoholic mother is a neglected child, and neglect in infancy may be a direct cause of death." Dr. Wiglesworth, Medical Superintendent of Rainhill County Asylum, thinks also that "a habit of excessive drinking tends in some cases to a poisoning of the germ cells of the parent by means of the alcohol circulating in the blood, and a consequent tendency on the part of these germ cells to develop into an organism with an unstable or badly developed brain." Hence the fact that the insane are often found to be the children of intemperate parents.

Any infectious disease from which the mother may be suffering, of course, may affect the child. Under this head comes syphilis, from which a fairly large number of children die each year (1·23 per cent. in 1907). "Fournier states that when infection has occurred before conception, the mortality is 65 per cent., and the morbidity, or actual occurrence of the disease, 70, while when infection has taken place after conception the mortality is 39, and the morbidity 72 per cent." He further states that out of 90 women, infected by their husbands, who became pregnant the year after infection, only two gave birth to children who survived (Newman, p. 68). Fortunately this disease is declining as a cause of death, but it is still terribly active, and numbers of children who survive infancy grow up degenerate, and suffering from congenital weakness, to fill our workhouses and asylums in later life.

The general risks owing to the employment of women are considered under the next heading.

(*d*) The Industrial Employment of Mothers.

The industrial employment of mothers has been held by many authorities to be one of the prime factors in high infant

mortality rates. Satisfactory statistics, as has already been said, are difficult to procure on this subject, but even without the help of elaborate figures it is obvious that, if the mother goes out to work, the baby is liable to be artificially fed, to be cared for by ignorant or neglectful persons, or to be left in danger of fire or starvation. It may also be exposed to cold and wet if it is taken from home daily to be cared for, as has already been mentioned more than once.

The industrial employment of pregnant women is, of course, open to other dangers, and undoubtedly in some cases leads to miscarriage, premature birth, and injury to mother and child, especially if the work consists of carrying or lifting heavy weights, or is in connection with dangerous trades, such as those using lead, phosphorus, mercury, or sulphuric acid, dry-cleaning or india-rubber works, etc.

Dr. Oliver's book on "Dangerous Trades" gives some most valuable information as to the effect of certain industries upon pregnant mothers. It has been abundantly proved that working in the dangerous processes of the Potteries, where lead or its compounds is used, is especially bad for women when pregnant. Out of 77 married women reported as suffering from lead poisoning during the year ending March, 1897, 15 had been childless and had no miscarriages; 8 had had 21 still-born children; 35 had had 90 miscarriages, and of these 15 had had no child born; 36 had had 101 living children, of whom 61 were still alive, the great majority of the 40 who died having succumbed to convulsions in infancy.

Dr. Newman also, in "Infant Mortality," gives interesting information. Among other injurious trades are mentioned those in which women act as "beasts of burden," *i.e.*, carrying weights, hat furriers, the linen industry, jute and hemp factories (Dundee), any work, such as laundry, where great fatigue is incurred.

But though undoubtedly much might be done to improve the conditions of factory labour for women, as to ventilation, sanitation, hours, and period of rest before and after confinement, both general knowledge and statistics seem to point to the fact that it is not so much the actual work done by the

woman or the factory *in itself* which is so injurious, but the absence of the mother from her baby and the decay of domesticity which is a natural outcome of the factory employment of married women. "Mother" and "home" are the two things for which there are no substitutes.

The municipal milk depôt and the municipal crêche are all very well as palliatives for social evils, but they are neither cures nor efficient substitutes for what must ever be an evil, *i.e.*, the removal of the mother from her home. The economic condition which should be aimed at is that fewer married women should be compelled to work for their livelihood, by raising the wages of men and lessening their times of unemployment, and by providing help for widows with young children and wives with invalid husbands.

Further legislative proposals on this subject are discussed in their natural place under the head of "Remedies."

(*e*) Undefined Causes, Illegitimacy, etc.

Finally, there are the undefined and unclassifiable causes, such as lack of natural love and desire on the part of the parents to preserve the life of the child, arising sometimes from inconvenience or poverty, and sometimes from an artificial or immoral life. The death-rate among illegitimate children is often more than twice as high as that among legitimate babies.

The following figures show how extraordinarily different the two rates are:—

	Deaths per 1,000 Births.	
	Illegitimate.	Legitimate.
Brighton, 1908	202	97
Leicester average, 1901–4 ...	305	158
„ 1905–8 ...	357	135

These are instances taken at random, and the figures will be found to be in the same proportions in most districts. The Medical Officer for Leicester remarks that "one is driven to the conclusion that only deliberate neglect in many cases can account" for the difference in the rate.

III.

REMEDIES.

It is quite impossible to write on such a subject as infant mortality without touching on the remedies which have been proposed, and which in some cases have actually been put to the test for shorter or longer periods.

It will be seen from Table V. that the majority of towns of over 100,000 inhabitants employ the services of health visitors, several have municipal milk depôts, one (Sheffield) gives out dried milk in the summer months, and a few have undertaken the feeding of necessitous mothers before and after confinement.

Remedies can be roughly classified under the following heads :—

(*a*) Education.

The elder girls in the elementary schools should be taught simple rules of hygiene, the care of their own health, and the feeding and care of infants. Education for the mothers can be given by trained midwives, health visitors, or by the distribution of cards or leaflets of instruction. Where there is a milk depôt the mothers who come for milk can receive instruction.

Health visitors have been appointed in a very large number of towns, and in many districts there are lady sanitary inspectors who combine the duties of health visitors. In some towns there are voluntary workers who visit under a trained lady inspector or health visitor, or under the medical officer. Where the Notification of Births Act (1907) has been adopted, their duty is to visit the house where the birth is notified and give instructions where necessary as to the feeding of the child, etc. A return visit is paid if it seems

needed. Cards of instruction as to feeding, etc., are distributed, and the health visitor, if tactful, is usually welcomed as a friend. Some little difficulty is occasionally found owing to the opposition of the untrained midwife or older mothers, who are full of ignorant superstitions, such as that it is unlucky to weigh a child, that a baby is starved on only milk and water, and needs flour, bread, etc., in addition. Mothers are addressed at their meetings on such topics as "Infant Feeding and the Care of the Child," "Health in the Home," "The Functions of the Blood," "Epidemic Diarrhœa." Practical demonstrations are given on poultice-making, the use of compresses, etc., working girls instructed on such subjects as "Health in the Workshop," "Personal Hygiene" (Salford). Health visitors have also been instrumental in obtaining most useful statistics. (*See* Table IX.)

(*b*) Aids to Mothers.

A system of insurance for the extra expenses of confinement, and for the enforced cessation from work, is a great need in the working classes. In some places charitable agencies or provident maternity clubs collect the payments, but the plan is not as largely adopted as it might be.

Food for nursing mothers was first provided free by voluntary agencies in France, where several simple restaurants have been started in which any mother bringing a baby at the breast can receive a free and nourishing meal. It has been proposed that power should be given to provide the necessary food for pregnant and nursing mothers out of the public funds in England, as the Poor Law Commission Report of 1909 abundantly proves that the present system quite fails to relieve the destitution which often causes Infant mortality. For the good of both mother and infant the woman whose resources actually do not permit of her procuring sufficient nourishment should receive assistance from some source, either public or private. (*See also* under Milk Depôts.)

The Midwives Act should help to lessen the rate of infant

mortality, as a fully trained and sensible midwife is the most likely person to influence an ignorant and foolish mother, and she is on the spot early enough to be able to prevent wrong methods at the very outset.

(*c*) Improved Sanitation.

It is scarcely necessary to say more about improved sanitation. All authorities agree as to the necessity for the abolition of privy middens and of the old-fashioned cumbrous dust-bins, the back-to-back houses, the courts where neither sun nor air can enter, and for the paving of back-yards, the scavenging of streets, etc., etc.

Under the head of "Diarrhœa" has already been pointed out the intimate connection between disease and dirt.

All infectious diseases spread more readily in insanitary areas. Diphtheria, enteric and scarlet fever, especially are usually more prevalent in such districts.

In Salford in 1908, although only 9 per cent. of the houses have privy middens, 25 per cent. of the infantile deaths from diarrhœa took place in such dwellings.

(*d*) Milk Depôts.

These are worked on various lines in different places, but the milk is usually only provided for those mothers who are certified by the medical man as unable to suckle their infants themselves, and it is paid for by all except the very needy. The milk is generally sterilised or pasteurised, is placed in bottles, each containing enough for one meal, sufficient bottles for each day being placed ready in a wire tray or basket. Full instructions are issued to each applicant, and the milk is prepared ready for use, and only needs placing in its bottle in a jug of hot water. Great stress is laid by most medical officers on the necessity for supervising the arrangements on the farms from which the milk actually comes. St. Helens was the first to start a milk depôt. Liverpool too has had a satisfactory depôt for several years, and Battersea and Finsbury, of the London districts, were among the earliest to

begin this work. It will be seen from Table V. that there are now a good number of these depôts. Some municipalities, however, prefer to give only dried milk. Some have their own dairies; others are content to purchase the purest milk obtainable from ordinary farms. The returns are necessarily incomplete, as some medical officers' reports could not be obtained, others give but meagre particulars, and no attempt was made to obtain this information from any towns with under 100,000 inhabitants.

Some towns combine with the milk depôt what the French call a *consultation de nourrissons*. The child is weighed and examined periodically, and medical help and advice is given usually both before and after confinement. Glasgow has a milk depôt of this kind.

In addition to the depôt for the feeding of the children, provision is made in some places for the feeding of mothers. This food is usually given out of voluntary funds, and is provided free for the very poor, or for a nominal cost for the ordinary working class mothers. (*See* Table V., two last columns.)

(*e*) Legislation.

There is not very much to be hoped for from legislation as to the employment of married women. Prohibition is quite impossible, and would be a great hardship to many of the very poor, and especially to those women who are widows or have sick husbands.

As has already been said, however, something could be done to improve the actual conditions of work for married women in factories. Much has already been accomplished by legislation in bettering the work of factories, but the Factory Act is still evaded in some places, and a larger staff of female inspectors is probably needed to see that all its provisions are carried out.

Also a strengthening of the law as to the employment of women before and after childbirth would probably be beneficial, although, unless this is combined with a system of insurance, it may lead to more poverty, owing to the loss of

wages, and also to increase in the use of artificial means to prevent conception or procure abortion.

At present the only protection the mother in industry has in England is the following easily evaded provision: "An occupier of a factory or workshop shall not knowingly allow a woman or girl to be employed therein within four weeks after she has given birth to a child." On such a subject the occupier can usually plead ignorance, or the woman can evade the law by going to work in a fresh factory where she is not known, and no provision is made for rest *before* her confinement, often an almost equally important matter. Moreover, it must be remembered that legislation is practically impossible as a help to the still greater number of married women employed in other ways. The larger numbers of married women in industry in 1901 were distributed as follows:—

Domestic offices or services ...	312,566
Charwomen	86,463
Laundry work	109,667
Textile fabrics	144,970
Dress	157,476
Bricks, pottery, and glass ...	9,201

In an investigation made by the Research Committee of the London branch of the Christian Social Union into the employment of married women engaged in household duties, home industries, or as charwomen, office cleaners, occasional laundresses, etc., it was found that a majority carried on their work right up to the time of confinement and resumed it in from ten to fourteen days after. In one case a woman actually recommenced work on the second day, and in five or six cases on the fourth day, after childbirth.

It must also be remembered that legislation may press hardly on the poorer workers in factories. Even as it is, foremen often ignore the law out of pity for the woman, knowing that she and her baby will actually starve without her wages.

The Germans have tried to solve the difficulty by a process of compulsory assurance, by which the working woman, while

prevented from working owing to childbirth, receives a sum equal to half her ordinary daily wages. By a recent enactment there is also an absolute prohibition of employment during six weeks from the time of confinement, or eight weeks before and after childbirth. In Austria, Belgium, and Holland employment is not allowed within four weeks, and in Denmark only under that time on the production of a medical certificate showing that the mother's employment will not be injurious to herself or the child. In Switzerland a total absence from employment in factories of women during eight weeks before and after childbirth must be observed, and on their return to work proof must be given of an absence since the birth of the child of at least six weeks. A longer abstinence from employment before confinement is also recommended in certain dangerous occupations, such as those using lead, phosphorus, mercury, or sulphuric acid, or in dry-cleaning and india-rubber works, or where there is the lifting or carrying of heavy weights or the risk of violent shocks, but the limit of the period is undefined, and there seems to be no means of enforcing the regulations. Still these regulations might form the basis for a very necessary reform in all countries ; it is just this absence from employment in these particular trades that might save so much suffering to both women and children.

Spain has a remedy for the difficulty of mothers in factories feeding their babies which might in some districts be adopted in England. Employers are obliged to allow one hour at least in the ordinary period of employment (for which there must be no deduction from wages) to nursing mothers to nurse their infants. This hour may be divided into two separate absences of half an hour, and may be fixed at pleasure by the mother, whose only obligation is to notify the times she chooses to the overlooker.

There is great need for legislation on one or two other points, notably as to the sale of drugs, infants' foods, powders, and soothing syrups, and for better regulations as to the sale of milk, the registration and inspection of dairies, milk-shops, etc., and the destruction of diseased cattle. Also the compulsory notification of all cases of phthisis would be a very good

thing. The Midwives Act, the Notification of Births Act, 1907, and the Children Act, 1908, as has already been said, have been steps in the right direction. The adoption of the Notification of Births Act, however, is optional, and it has not yet been adopted by all local authorities throughout the country. Unless it is in force, the health visitor, even if she exists at all, cannot possibly visit the home early enough to be of much service. It is the first few weeks which are so important in the life of the child.

(*f*) Influences towards a more Natural and Healthy Way of Living; Moral and Religious Teaching.

Finally, it must be said that even if given a clean sty the pig cannot be made a cleanly animal. It is moral and educational influences which are the most important factors.

Health visitors, education, sanitation, legislation, milk depôts, are only means to an end. Machinery alone will achieve little; the personal element behind it counts for far more.

Motherhood and domesticity will decay where the ideals are degraded and the nature is debased. Anything which tends to raise the ideal and the spiritual side of life will tend to lower infant mortality. Where children are looked upon as the "gift of God," there they are not allowed to "slip through the fingers"; where they are in the way and not wanted, they very soon "go back," to use the phraseology of the midlands.

CONCLUSION.

In conclusion, one great fact underlying the whole social question of the infant mortality rate must never be lost sight of, namely, that a high "death-rate" means a high "damage-rate," and necessarily a high rate of suffering. It is *not* that the fit survive and the unfit perish; it is—

(1) That thousands of healthy babies are yearly done to death by preventable diseases and unnecessarily evil surroundings;

(2) That thousands more babies are crippled, have their digestive organs seriously impaired, are sown with the seeds of phthisis, become feeble-minded and physically deteriorated, because they have never had a chance to live a healthy life;

(3) That a certain number of babies are born unfit to live owing to unnatural social conditions, and the evils of poverty, drink, disease, and undue industrial pressure, amid which their mothers live.

Shall such things be? Surely on every ground no efforts can be too great to lessen this waste of human life.

From a material point of view, it is an economic absurdity that the mother should waste her strength in producing what is never to have a chance to live. She is less efficient industrially for child-bearing, she is less efficient as a parent because she works too hard for her living, whether as housewife or factory worker makes very little difference to this point.

Again, speaking of the expensive provision for defective and crippled children, Mr. John Burns said at the conference in 1908: "If half the money expended now had been spent on the mother, the child, and the home, twenty, ten, or even five years ago, our special schools would not be

needed." It is the old proverb which should be remembered, "Prevention is better than cure."

On humanitarian grounds it is obviously impossible to justify the suffering caused to innocent human creatures under one year old by preventable disease and death.

On moral grounds there is room for much reflection as to whether civilisation, combined with such enormous industrial pressure and competition, does indeed lead to either wealth or righteousness.

Among the rural population of Ireland, which keeps its simple faith and its primitive habits, where the cabins are shared by animals and human beings alike, where modern sanitation of any sort is unknown, and immorality is almost unheard of,[1] the infant mortality rate is only 70·2 per 1,000 births, and it is only 91·7 in the whole of Ireland. Again, in the primitive strenuous life of the north of Scotland, in Orkney and Shetland, there is an infant death-rate of only 39·3 and 47·9; in the mainland rural of Scotland, 88·5; insular rural, 53·2.

If civilisation brings its advantages, it certainly brings its dangers. But a glance at the comparative rates for different districts in London or any large town will show that urbanity alone is not the cause of the excessive rate in our great cities. As has already been said, neither do even overcrowding and density per acre in *themselves* necessarily cause the death of these infants. Hampstead in 1907 had a death-rate of only 69 per 1,000 births, Shoreditch 150 per 1,000 births. (*See* Table XI.)

What is wanted is a return to more natural ways of living, the opportunity and possibility for healthful ways of earning and spending money, room to live in decency, efficient sanitation, rational and practical education, and pure and cheap recreation. Real education and more attractive surroundings should do much to check the vices of intemperance and immorality.

[1] The illegitimate birth-rate in the province of Connaught is ·06 per cent. of total births (all Ireland, 2·5 per cent.), as compared to 3·9 in England and 6·4 in Scotland.

If all cities could be "garden cities," there would be little heard of infant mortality. In the haste for expansion, in the blind industrial competition, of the last century, houses were run up "anyhow," streets planned "no how," back yards built over, houses made back to back, and courts enclosed from light and air; monotony prevailed, and the gin-palace at the corner is the only relief to the eye in these dreary streets. The once better-to-do houses are swarming with a family in each room, with no kitchen, larder, sink, yard, or convenience. Little wonder that "the people perish" where there is not only "no vision," but no possibility of vision!

The motto of every public health authority and of every social worker must be "*Onward Ever.*" With things as they are we can never be content.

The old words of Blake, the poet, come to one's mind, oft quoted as they are:—

> "I will not cease from mental fight,
> Nor shall my sword sleep in my hand,
> Till we have built Jerusalem
> In England's green and pleasant land."

That it is neither green nor pleasant in many thousands of acres we know only too well. Let us see that something approaching the ideal citizenship of Jerusalem is made more possible to every human creature.

EXPLANATION OF TABLES.

Crude death-rate (death-rate at all ages and sexes) is based on the number of persons dying in each area in proportion to the total number of persons living in the same area. *Corrected death-rate* means the same figures corrected by calculating the proportion of age and sex risk. Risk of death is naturally greater in infancy and old age than in the prime of life, and males have a higher death-rate than females. Urban figures rise and rural figures fall on correction of the death-rate, owing to the fact that those in the prime of life press into the towns to obtain work. Where not otherwise stated it is the crude death-rate which is given in these tables. The figures are for deaths during the year per 1,000 of persons living.

Birth-rate means number born per 1,000 of total population.

The *infant mortality rate* is based on the proportion of infants dying under one year old in one year in any area out of the total number born. It is usually reckoned per 1,000 births, and this system is adhered to throughout this paper.

Density per acre means the number of persons living in the place in proportion to each acre of the area.

The figures given in the tables are all official, or are calculated from figures given in official publications.

TABLE I.

Rates, 1861—1908.

Year.	England and Wales.		Average for Ten Years.	Scotland.		Average for Ten Years.
	Death-rate per 1,000 living of all Population.	Deaths of Children under one Year to 1,000 Births.		Death-rate per 1,000 living of all Population.	Deaths of Children under one Year to 1,000 Births.	
1861 ...	21·6	153		20·3	110·9	
1862 ...	21·4	142		21·6	117·3	
1863 ...	23·0	149		22·8	120·0	
1864 ...	23·7	153		23·5	126·2	
1865 ...	23·2	160	1861—1870	22·2	124·7	
1866 ...	23·4	160	= 154	22·1	122·4	121·0
1867 ...	21·7	153		21·2	118·6	
1868 ...	21·8	155		21·1	117·7	
1869 ...	22·3	156		22·9	129·3	
1870 ...	22·9	160		22·2	122·8	
1871 ...	22·6	158		21·1	130·3	
1872 ...	21·3	150		22·2	123·9	
1873 ...	21·0	149		22·3	124·9	
1874 ...	22·2	151		23·2	124·9	
1875 ...	22·7	158	1871—1880	23·2	132·1	
1876 ...	20·9	146	= 149	20·8	121·2	122·8
1877 ...	20·3	136		20·5	114·9	
1878 ...	21·6	152		21·1	123·0	
1879 ...	20·7	135		20·0	107·9	
1880 ...	20·5	153		20·4	124·6	
1881 ...	18·9	130		19·3	112·5	
1882 ...	19·6	141		19·3	118·0	
1883 ...	19·6	137		20·2	119·0	
1884 ...	19·7	147		19·6	117·9	
1885 ...	19·2	138	1881—1890	19·3	120·5	
1886 ...	19·5	149	= 142	18·9	115·7	119·1
1887 ...	19·1	145		19·0	122·2	
1888 ...	18·1	136		18·0	113·1	
1889 ...	18·2	144		18·4	121·3	
1890 ...	19·5	151		19·7	130·6	
1891 ...	20·2	149		20·7	127·9	
1892 ...	19·0	148		18·5	117·5	
1893 ...	19·2	159		19·3	136·0	
1894 ...	16·6	137		17·0	116·7	
1895 ...	18·7	161	1891—1900	19·4	133·4	
1896 ...	17·1	148	= 154	16·6	115·5	127·9
1897 ...	17·4	156		18·4	137·9	
1898 ...	17·5	160		18·0	134·2	
1899 ..	18·2	163		18·1	131·0	
1900 ...	18·2	154		18·5	128·5	
1901 ...	16·9	151		17·8	129·4	
1902 ...	16·2	133		17·2	113·4	
1903 ...	15·4	132		16·5	117·5	
1904 ...	16·2	145	1901–08	16·8	123·1	
1905 ...	15·2	128	= 133	15·9	116·2	= 119·1
1906 ...	15·4	132		16·0	115·0	
1907 ...	15·0	118		—	—	
1908 ...	14·7	121		—	—	

Ireland.

Average 1897—1906	17·5 ...	102
,, 1906	17·0 ...	93
,, 1907	17·7 ...	92

For comments, *see* Introduction.

TABLE II.

Lowest Rates of Infant Mortality.

England and Wales, 1907.			Scotland, 1906.		
Counties.	Corrected Death-rate per 1,000 living.	Deaths under One Year per 1,000 Births.	Counties.	Corrected Death-rate per 1,000 living.	Deaths under One Year per 1,000 Births.
Huntingdonshire.	11·0	73	Orkney ...	12·38	39·3
Radnorshire ...	9·7	74	Shetland ...	10·89	47·9
Wiltshire ...	11·9	77	Peebles ...	11·90	61·8
Dorset	11·8	77	Ross and Cromarty ...	12·16	69·5
Hertfordshire ...	12·1	80	Argyll	14·65	68·7
Berkshire ...	11·7	83	Bute	13·51	75·2
Buckingham ...	11·2	84	Perth	13·55	77·9
Herefordshire ...	11·9	87	Sutherland ...	11·40	80·3
Westmoreland ...	11·2	87	Inverness ...	13·37	84·0
Average of above nine counties...	11·4	80	Average of above nine counties	12·65	67·2
England and Wales { 1906	15·4	132	Scotland { 1906	16·00	115·0
England and Wales { 1907	15·0	118	Scotland { 1907	16·18	—

Ireland, 1907.

Rural population	—	70
Whole of Ireland	17·7	92

TABLE III.

Highest Rates of Infant Mortality.

England and Wales, 1907.			Scotland, 1906.		
Counties.	Corrected Death-rate per 1,000 living.	Deaths under One Year per 1,000 Births.	Counties.	Corrected Death-rate per 1,000 living.	Deaths under One Year per 1,000 Births.
Nottingham ...	16·4	146	Forfar	17·30	139·5
Lancashire ...	18·8	138	Lanark... ...	17·91	129·2
Glamorgan ...	17·4	136	Stirling ...	15·87	120·7
Durham	17·8	135	Dumbarton ...	18·07	119·7
Staffordshire ...	16·2	133	Edinburgh ...	16·94	116·8
West Riding ...	16·8	131	Linlithgow ...	14·58	113·4
North Riding (Yorks.) ...	17·2	127	Renfrew ...	19·37	110·6
Merioneth ...	13·9	127	Dumfries ...	16·33	110·2
Monmouth ...	16·7	126	Aberdeen ...	13·54	109·4
Warwick... ...	15·6	126	Ayr	14·38	107·5
Average of above ten counties or divisions ...	16·7	132	Average of above ten counties...	16·4	117·7
England and Wales { 1906	15·4	132	Scotland { 1906	16·0	115·0
England and Wales { 1907	15·0	118	Scotland { 1907	16·18	—

Ireland, 1907.

Civic unions	—	124
Whole of Ireland	17·7	92

TABLE IV.

Scotland.

Averages 1855—1906.

—	General Death-rate per 1,000 living.		Deaths under One Year per 1,000 Births.						
	1855—60.	1906.	1855—60.	1861—70.	1871—80.	1881—90.	1891—1900.	1901—6.	1906.
Principal towns [1] ...	27·41	16·57	157·5	151·2	149·8	140·3	147·4	136·1	128·8
Large towns [2] ...		16·87			133·9	127·2	133·6	122·3	119·6
Small towns [3] ...	16·45	15·16	94·8	99·6	118·1	111·9	121·4	112·4	108·7
Mainland rural ...		15·09			90·6	88·7	95·3	89·2	88·5
Insular rural		15·28	88·8	83·1	81·0	72·4	75·7	74·1	53·2
Scotland		16·00	119·6	121·1	122·7	119·0	127·9	119·9	115·0

[1] includes all towns with over 25,000 inhabitants, after 1900 those over 30,000.
[2] includes ,, ,, ,, 10,000 ,,
[3] includes ,, ,, ,, 3,000 ,, , after 1871 those over 2,000.

Note.—In 1855—60 the excess of the death-rate of the principal towns over that of the mainland rural was 10·96, in 1906 only 1·48; but the excess of the infant mortality in the principal towns was 60·3 over the mainland rural in 1906, though in 1855—60 it was only 62·7, showing that the ordinary death-rate has improved much more rapidly in the towns than the infant mortality rate.

INFANT MORTALITY, ENGLAND A

ENGLAND AND WALES.	Population.		Density per Acre.	Birth-rate, 1908.	Death-rate per 1,000 living, 1908.		
	Census, 1901.	Estimated, 1907.			Corrected.	Crude recorded.	1894—
London . . .	4,536,541	4,758,218	—	26·9	14·5	13·8	15
Liverpool . .	704,134	746,144	44·9	31·7	20·5	19·2	18
Manchester . .	606,824	643,158	33·0	29·1	20·2	18·2	18
Birmingham . .	522,204	553,155	44·2	28·4	16·1	15·9	18
Leeds . . .	428,968	470,268	18·2[1]	24·8	16·7	15·3	17
Sheffield . .	409,070	455,553	19·3	31·0	17·0	15·9	18
Bristol . . .	328,945	367,979	20·8	23·1	13·9	13·5	14
Bradford . .	279,767	290,322	12·7	20·2	17·1	15·4	16
West Ham . .	267,358	308,284	66·9[2]	28·8	14·8	13·8	16
Hull . . .	240,259	266,762	28·9	30·2	16·6	16·1	17
Nottingham . .	239,743	237,489	21·9[1]	26·6	16·0	15·2	18
Salford . . .	220,957	236,670	37·8[1]	29·6	19·6	17·9	19
Newcastle-on-Tyne	215,328	272,969	31·9[1]	29·7	17·2	17·3	17
Leicester . .	211,579	236,124	24·6	23·6	13·9	12·9	18
Portsmouth . .	188,133	208,291	37·0	28·4	14·1	13·7	15
Bolton . . .	168,215	182,917	11·9	24·6	17·4	15·5	17
Cardiff . . .	167,592	187,620	22·7[2]	26·6	14·1	12·9	15
Sunderland . .	146,077	156,029	43·5[1]	33·0	18·5	17·7	17
Oldham . . .	137,246	141,730	30·1[2]	28·0	22·2	19·2	17
Croydon . .	133,895	157,698[1]	17·4	25·5	13·1	13·0	13
Blackburn . .	129,216	134,438	18·0	25·0	17·7	15·6	19
Brighton . .	123,478	129,023	49·6[2]	21·2	14·4	14·7	15
Derby . . .	114,848	125,774	20·5[1]	25·9	14·1	13·0	15
Norwich . .	113,922	122,841[2]	15·5	25·2	13·4	14·0	17
Rhondda . .	113,735	130,400	—	40·3	20·2	18·4	19
Preston . . .	112,989	117,093	29·2[2]	27·7	19·6	17·9	22
Birkenhead . .	110,915	118,553	15·7[1]	31·4	16·8	15·8	16
Gateshead . .	109,888	125,783	39·4	31·0	15·7	14·9	17
Plymouth . .	107,636	120,063	41·1[1]	22·2	14·5	15·0	16
Halifax . . .	104,936	110,138	8·0[2]	19·0	12·2	14·1	14
Southampton .	104,824	119,745	43·6[1]	23·9	12·8	12·9	14
South Shields .	100,858	113,460	47·3	30·1	16·4	15·5	15

N.B.—In cases where they could be obtained figures are taken from th
in all other cases from Annual Summary of Births, Deaths, etc. In so
given in these different authorities owing to different ways of calculati

[1] Area (registration), and population, 1901. Where no figure for densit
has not been possible to calculate it, owing to variation in area, in available

[2] 1908.

(a).

s, Thirty-three Largest Towns.

inder One Year per 1,000 Births.					Remedies.			
1904.	1905.	1906.	1907.	1908.	Notification of Births Act adopted.	Health Visitors.	Milk Depôts.	Food for Mothers.
146	131	131	116	113	No 11. Yes 18[8]	21	—	—
196	153	171	143	141	Yes	Yes	Yes	Yes
186	158	169	147	151	No	Yes (vol.)	—	—
195	155	168	147	145	Yes	Yes	—	—
175	151	151	130	138	—	Yes	—	—
158	166	158	145	141	Yes	Yes	Dried milk	—
133	122	127	101	126	—	Yes?	—	—
167	144	152	124	143	Yes	Yes	—	Yes
162	153	150	131	128	Yes	Yes	—	—
181	153	181	126	145	Yes	Yes	—	—
176	155	171	165	146	Yes	Yes	—	—
192	148	161	140	153	—	Yes	—	—
156	135	153	125	139	Yes	Yes	—	—
161	146	166	130	129	No	Yes	Yes, and dried milk	—
142	134	130	123	99	No	Yes	—	—
167	166	138	145	148	Yes	Yes	—	—
146	118	138	131	126	Yes	Yes	—	—
164	142	140	130	147	—	Yes	—	—
156	150	146	144	160	Yes	Yes	—	—
128	96	125	94	99	Yes	Yes	—	—
191	146	155	151	151	Yes	Yes	—	Yes
133	102	111	111	104	—	—	—	—
143	151	115	121	112	Yes	Yes	—	—
180	174	172	124	115	Yes	Yes	—	Yes
190	200	174	162	184	No	—	—	—
185	154	199	158	154	Yes	Yes	—	—
181	127	151	110	136	—	—	—	—
173	139	163	136	149	No	No	No	No
172	135	152	110	129	—	Yes	—	–
128	131	115	103	101	Yes	Yes	—	—
115	132	113	108	113	Yes	Yes	—	—
144	145	150	133	133	No	Yes	—	—

officer of healths' reports, the figures are differently

is given, it is because it

N.B.—These columns are necessarily incomplete, owing to sufficient information not being obtainable.

[8] Out of 29 sanitary areas.

TABLE VII.—Causes of Infant Mortality, 1907.

Proportion of Deaths to 1,000 Births.

	England and Wales.		Urban Counties.		Rural Counties.	
	Under One Month.	Under One Year.	Under One Month.	Under One Year.	Under One Month.	Under One Year.
Common infectious diseases	0·17	8·67	0·16	9·77	0·15	6·58
Diarrhœal diseases	0·99	14·06	1·10	16·63	0·84	9·16
Premature birth (Wasting diseases.)	17·89	19·85	18·22	20·21	15·74	17·54
Congenital defects (Wasting diseases.)	4·91	6·60	5·03	6·72	4·08	5·64
Injury at birth (Wasting diseases.)	0·88	0·89	0·89	0·90	0·74	0·74
Want of breast milk, starvation (Wasting diseases.)	0·15	0·83	0·16	0·90	0·14	0·71
Atrophy, debility, marasmus (Wasting diseases.)	7·08	15·01	6·96	15·69	8·14	15·13
Wasting diseases.	30·91	43·18	31·25	44·42	28·84	39·76
Tuberculous diseases	0·08	4·54	0·09	4·97	0·07	3·30
Bronchitis, laryngitis, and pneumonia	1·75	23·43	1·97	26·26	1·01	17·35
Convulsions	4·21	11·06	4·51	11·81	4·28	11·30
Suffocation	0·58	1·88	0·72	2·33	0·32	1·02
Other causes (including syphilis, 1·23)	1·99	10·80	2·06	11·47	2·10	10·11
All causes	40·68	117·62	41·87	127·66	37·61	98·58

TABLE VIII. (a).—Causes of Death under One Year.

Typical Towns, 1908.

	Longton (Potteries).		Blackburn (Textile).		Croydon (Mixed Industries).	
	Actual Numbers.	Percentage per 100 Deaths.	Actual Numbers.	Percentage per 100 Deaths.	Actual Numbers.	Percentage per 100 Deaths.
Common infectious diseases	6	2·4	21	4·1	32	8·0
Diarrhœal diseases	76	30·8	115	22·5	62	15·6
Premature births (Wasting diseases.)	23	9·3	66	13·0	65	16·3
Congenital defects (Wasting diseases.)	10	4·0	25	5·0	19	4·8
Injury at birth (Wasting diseases.)	1	0·4	1	0·2	4	1·0
Want of breast milk, starvation (Wasting diseases.)	—	—	—	—	—	—
Atrophy, debility, marasmus (Wasting diseases.)	34	13·8	78	15·2	80	20·1
Wasting diseases.	68	27·6	170	33·3	168	42·2
Tuberculous diseases	6	2·4	23	4·5	15	3·8
Bronchitis, laryngitis, and pneumonia	47	19·1	88	17·2	64	16·1
Convulsions	26	10·5	27	5·2	18	4·6
Suffocation	2	0·8	13	2·5	4	1·0
Other causes	15	6·0	53	10·4	35	8·8
All causes	246	—	510	—	398	—

Infant mortality, *i.e.*, deaths under one year per 1,000 births, 1908—Longton = 183; Blackburn = 151; Croydon = 99.

Note.—In the first column is given the actual number of deaths of infants during the year, in the second the proportion per cent. dying from each disease in each town.

TABLE VIII. (b).

Mortality in each Sex.

It might be thought that with infants under one year the rate would be the same in both sexes, but, as a matter of fact, male infants are far more difficult to rear than female. Boys succumb more readily to most diseases than girls, and urbanity affects them more than it does the girl babies.

These are the figures for 1907:—

Infant Mortality.

England and Wales, boys	...	44·7
,, ,, girls	...	37·0
Urban counties, boys	...	50·9
,, ,, girls	...	42·2
Rural counties, boys	...	33·3
,, ,, girls	...	26·5

per 1,000 living.

Every year more boys are born than girls. In 1907 103 boys to 100 girls were born in England and Wales, but the male death-rate at all ages was 16·0, as against 14·1.

Infant Mortality, 1907.

	Males.	Females.
Common infectious diseases	8·52	8·80
Diarrhœal diseases	15·64	12·42
Wasting ,, ...	48·19	37·94
Tuberculous ,, ...	5·01	4·08
Other causes	52·90	41·25
	130·26	104·49

TABLE IX.

Comparative Rates: Different Methods of Feeding.

	Breast-fed.			Breast and other Milk or Food.			Fresh Cows' Milk.			Other Food.			Condensed Milk.		
	Per cent. so fed.	Deaths per 1,000 Births.		Per cent. so fed.	Deaths per 1,000 Births.		Per cent. so fed.	Deaths per 1,000 Births.		Per cent. so fed.	Deaths per 1,000 Births.		Per cent. so fed.		
Salford, 1907	—	88·6		—	172·4		—	246·3		—	241·3		—	—	
,, 1908	85·2	97·4		5·4	177·5		7·1	284·0		2·5	122·8		—	—	
		Diarrhœa.	Other Diseases.		Diarrhœa.	Other Diseases.		Diarrhœa.	Other Diseases.		Diarrhœa.	Other Diseases.		Diarrhœa.	Other Diseases.
Croydon, 1908	65·8	8·8	61·4	17·6	14·6	106	9·8	65	157	2·9	22	133	3·9	129	113

Deaths of Children under One Year in Third Quarter of Year from Diarrhœa.			England and Wales.	Deaths of Infants under One Year per 1,000 Births in Third Quarter.	Mean Temperature of Earth at depth of 3 ft. 2 in.	Amount of Rainfall.
—	Breast-fed.	Mixed Diet.				Inches.
Hull, July 1st to September 30th, 1903	26	186	1903	139	60·2	12·3
,, ,, ,, ,, 1904	81	309	1904	208	61·4	4·8
,, ,, ,, ,, 1905	42	216	1905	171	61·6	5·8
,, ,, ,, ,, 1906	30	240	1906	187	62·0	3·8
,, ,, ,, ,, 1907	11	40	1907	98	59·2	3·5
			1908	129	60·2	8·2

Note.—It will be seen that there is an intimate connection between a hot, dry summer and a high infant mortality rate in the third quarter of year, also between diarrhœa and artificial feeding.

TABLE X.

International Statistics, Infant Mortality.

—	North or South or Mid.	Crude Death-rate per 1,000 living, 1901—5.	Deaths of Children under One Year per 1,000 Births. Averages. 1901—5.	1906.	1907.
(*a*) British Empire.					
England and Wales ...	—	16·0	138	132	118
Scotland	—	16·9	120	115	—
Ireland	—	17·6	98	93	92
Jamaica	—	22·6	174	197	—
Ceylon	—	26·7	171	198	—
Ontario, province of ...	—	13·0	138	162	—
Western Australia ...	—	12·4	126	110	98
New South Wales ...	—	11·2	97	75	89
Victoria	—	12·7	96	93	73
Queensland	—	11·4	95	75	77
Tasmania	—	10·8	90	91	82
South Australia	—	10·8	87	76	66
New Zealand	—	9·9	75	62	89
(*b*) European Countries.					
Russia, European ...	N.	31·9[1]	261[1]	—	—
Austria	M.	24·2	215[2]	—	—
Hungary	M.	26·2	212	205	208
Prussia	N.	19·6	190	177	168
Spain	S.	25·8	173	173	—
Italy	S.	21·9	168	161	—
Servia	S.	22·4	149	144	—
Belgium	N.	17·0	148	153	—
Bulgaria	S.	22·7	146[2]	—	—
France	M.	19·6	139	143	—
The Netherlands	N.	16·0	136	127	112
Switzerland	M.	17·7	134	127	—
Finland	N.	18·6	131	119	—
Denmark	N.	14·8	119	109	—
Sweden	N.	15·5	91	—	—
Norway	N.	14·5	81	69	—

[1] 1896—1900. [2] Four years.

(*c*) Averages.

	United Kingdom.	Colonies (eight).	Northern European Countries[1] (eight).	Mid-European Countries (four).	Southern European Countries (four).
Infant mortality—					
1901—5 ...	119	100	145	175	159
1906	113	93	—	—	—
Death-rate per 1,000 living—					
1901—5 ...	16·8	11·5	18·5	21·9	23·2

Note.—Although the ordinary death-rate in Southern (or hottest) European countries is considerably the highest, yet the infant mortality rate in the mid (or chief *industrial*) countries is very much the highest. Both the ordinary death-rate and the infant mortality rate are lowest in the northern and more agricultural countries.

[1] Including European Russia, 1896—1900.

TABLE XI.

London: Ten Highest and Lowest Districts, 1908.

Highest Rates of Infant Mortality.

—	Birth-rate, 1908.	Death-rate per 1,000 living, 1908.	Death-rate from Diarrhœa.		Infant Mortality. Deaths under One Year per 1,000 Births.	
			1903—7.	1908.	1903—7.	1908.
Bermondsey	32·5	19·2	1·04	0·84	150	144
Shoreditch	32·0	18·3	1·28	1·00	167	139
Finsbury	31·1	19·3	0·93	0·97	147	133
Bethnal Green ...	32·6	17·3	0·94	0·77	147	132
Southwark	29·2	17·0	0·95	0·88	148	131

Lowest Rates of Infant Mortality.

Hampstead	14·9	9·6	0·17	0·13	87	69
Lewisham	23·0	11·4	0·52	0·40	102	86
Stoke Newington ...	19·7	12·9	0·42	0·35	109	92
City of London ...	14·9	19·4	0·23	0·10	115	92
Woolwich	23·8	12·1	0·68	0·36	113	94